

**SEMICONDUCTOR INTEGRATED CIRCUIT DEVICE**

[半導体集積回路装置]

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UNITED STATES PATENT AND TRADEMARK OFFICE

Washington, D.C.

June 2005

Translated by: Schreiber Translations, Inc.

(19) [Publication Office]

Japan Patent Office (JP)

(12) [Kind of Document]

Unexamined Patent Publication (A)

(11) [Publication Number of Unexamined Application]

Japan Unexamined Patent Publication Hei 10-242355

(43) [Publication Date of Unexamined Application]

1998 (1998) September 11

(43) [Publication Date of Unexamined Application]

1998 (1998) September 11

(54) [Title of Invention]

**SEMICONDUCTOR INTEGRATED CIRCUIT DEVICE**

(51) [International Patent Classification, 6th Edition]

H01L 23/40

23/12

23/28

[FI]

H01L 23/40 E

23/28 B

23/12 L

[Number of Claims]

[Form of Application]

OL

[Number of Pages in Document]

6

[Request for Examination]

Not yet requested

(21) [Application Number]

Japan Patent Application Hei 9-40205

(22) [Application Date]

1997 (1997) February 25

(71) [Applicant]

[Identification Number]

5108

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(57) [Abstract]

[Problems to be Solved by the Invention]

In semiconductor integrated circuit device, with low thermoresistivity, exfoliation and crack which occur in joint interface between different material of thermal expansion coefficient, modulus are decreased.

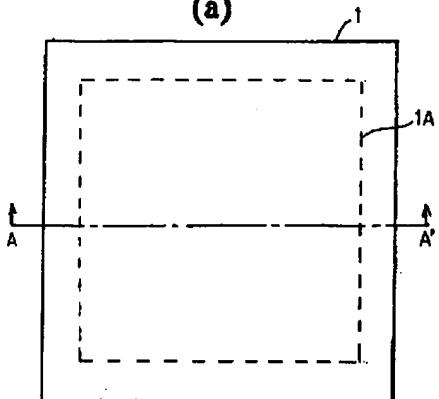
[Means to Solve the Problems]

With semiconductor integrated circuit device where it can provide heat release sheet on surface of the package of main surface and opposing side where semiconductor element is formed, portion of the aforementioned heat release sheet hooking potting resin of the aforementioned package, it is something which becomes hook structure which engages.

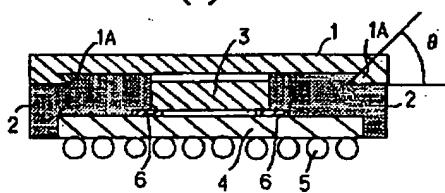
In addition, with semiconductor integrated circuit device where it can provide heat release sheet on the surface of package of main surface and opposing side where semiconductor element is formed, it is something which penetrating hole of inverted cone or inverted pyramid condition at least one is provided at least in portion inside the aforementioned heat release sheet plane.

図 1

(a)



(b)



[Claim(s)]

[Claim 1]

With semiconductor integrated circuit device where it can provide heat release sheet on surface of the package of main surface and opposing side where semiconductor element is formed, portion of the aforementioned heat release sheet hooking potting resin of the aforementioned package, hook structure which engages, semiconductor integrated circuit device. which designates that it is as feature

[Claim 2]

With semiconductor integrated circuit device where it can provide heat release sheet on surface of the package of main surface and opposing side where semiconductor element is formed, periphery edge of the aforementioned heat release sheet part hooking potting resin of the aforementioned package at least, semiconductor integrated circuit device. which designates that it becomes hook structure which engages as feature

[Claim 3]

With semiconductor integrated circuit device where it can provide heat release sheet on surface of the package of main surface and opposing side where semiconductor element is formed, in the flat part of the aforementioned heat release sheet semiconductor integrated circuit device. which designates that the at least one it provides penetrating hole of inverted cone or inverted pyramid condition as feature

[Claim 4]

With semiconductor integrated circuit device where it can provide heat release sheet on surface of the package of main surface and opposing side where semiconductor element is formed, in the flat part of the aforementioned heat release sheet semiconductor integrated circuit device. which designates that the at least one it provides hole of inverted cone or inverted pyramid condition as feature

[Claim 5]

With semiconductor integrated circuit device where it can provide heat release sheet on surface of the package of main surface and opposing side where semiconductor element is formed, periphery edge of the aforementioned heat release sheet part hooking potting resin of the aforementioned package at least, we have become hook structure which engages, In flat part of the aforementioned heat release sheet semiconductor integrated circuit device. which designates that at least one it provides hole of penetrating hole or inverted cone or inverted pyramid condition of inverted cone or inverted pyramid condition as feature

[Claim 6]

In inside surface part of the aforementioned heat release sheet semiconductor integrated circuit device. which is stated in inside any one claim of Claims 1 through 5 which designates that at least one it provides unevenness as feature

[Claim 7]

semiconductor integrated circuit device. which is stated in Claim 6 which designates that heat radiating fin is provided in top of the aforementioned heat release sheet as feature

[Claim 8]

heat spreader Attached the aforementioned package and semiconductor integrated circuit device. which is stated in inside any one claim of Claims 1 through 5 which designates that it is a ball grid array (BGA) type as feature

[Claim 9]

semiconductor integrated circuit device. which is stated in Claim 8 which designates that heat radiating fin is provided in top of the aforementioned heat spreader as feature

[Description of the Invention]

[0001]

[Technological Field of Invention]

this invention, it regards semiconductor integrated circuit device, especially, and apply to heat spreader attached ball grid array (HBGA) type semiconductor integrated circuit device and it is something regarding effective technology.

[0002]

[Prior Art]

Recently, regarding semiconductor integrated circuit device, quantity of input-output pin which is not has increased quickly in trend to high integration of semiconductor element.

As for QFP (Quad Flat package) or other package which provides external terminal in periphery of the package because insulating between pin is maintained at time of extent and solder connection which become multi pin from constraint that below constant interval external terminal cannot be arranged package is a tendency which scale-up is done.

Because of this mounting efficiency decreases, deterioration of electrical property damages to occur easily, ball grid array (BGA) type package which in package rear surface provides external terminal in lattice is developed.

[0003]

On one hand also heat emission of pellet has traced course of increase, especially, with high performance device low

thermoresistivity conversion of package is attached importance.

[0004]

package of HBGA type which from background a this way provides heat spreader in top of mold resin (resin) is developed.

[0005]

[Problems to be Solved by the Invention]

this inventor, discovered problem of result and below the aforementioned Prior Art was examined.

[0006]

With the aforementioned Prior Art, there was a problem that at time of production process where thermal contraction after mold happens at time of connecting between different material of thermal expansion coefficient, modulus, and with on/off (ON, OFF) of switch at time of temperature cycle exfoliation and crack occur in mold resin (resin) boundary.

[0007]

objective of this invention is to offer technology whose it is possible to decrease exfoliation and crack which occur in joint interface between different material of thermal expansion coefficient, modulus.

[0008]

As for other objective of this invention, with low thermoresistivity, at same time, potting resin (mold resin) with it is to offer semiconductor integrated circuit device of package of the HBGA type whose it is possible to decrease exfoliation and crack which occur in boundary of heat release sheet.

[0009]

Description above of this invention and other objective and novel feature from description and attached figure of this specification become clear.

[0010]

[Means to Solve the Problems]

If among inventions which are disclosed in this application, gist of representative ones is explained simply, below-mentioned sort is.

[0011]

(1) With semiconductor integrated circuit device where it can provide heat release sheet on surface of the package of main surface and opposing side where semiconductor element is formed, portion of the aforementioned heat release sheet hooking potting resin of the aforementioned package, it is something which becomes hook structure which engages.

[0012]

(2) With semiconductor integrated circuit device where it can provide heat release sheet on surface of the package of main surface and opposing side where semiconductor element is formed, the periphery edge of the aforementioned heat release sheet part hooking potting resin of the aforementioned package at least, it is something which becomes hook structure which engages.

[0013]

(3) With semiconductor integrated circuit device where it can provide heat release sheet on surface of the package of main surface and opposing side where semiconductor element is formed, it is something which penetrating hole of inverted cone or inverted pyramid condition at least one is provided in flat part of the aforementioned heat release sheet.

[0014]

(4) With semiconductor integrated circuit device where it can provide heat release sheet on surface of the package of main surface and opposing side where semiconductor element is formed, it is something which hole of inverted cone or inverted pyramid condition at least one is provided in flat part of the aforementioned heat release sheet.

[0015]

(5) With semiconductor integrated circuit device where it can provide heat release sheet on surface of the package of main surface and opposing side where semiconductor element is formed, the periphery edge of the aforementioned heat release sheet part

hooking potting resin of the aforementioned package at least, we have become hook structure which engages, It is something which hole of penetrating hole or inverted cone or inverted pyramid condition of inverted cone or inverted pyramid condition at least one is provided in the flat part of the aforementioned heat release sheet.

[0016]

(6) In each semiconductor integrated circuit device of the aforementioned means, it is something which unevenness at least one is provided in inside surface part of the aforementioned heat release sheet.

[0017]

(7) In each semiconductor integrated circuit device of the aforementioned means, it is something which provides heat radiating fin in top of the aforementioned heat release sheet.

[0018]

(8) the aforementioned package and it is a heat spreader Attached ball grid array (BGA) type.

[0019]

(9) It is something which provides heat radiating fin in top of the aforementioned heat spreader.

[0020]

According to the aforementioned means, portion of heat release sheet hooking potting resin of the aforementioned package, because it becomes hook structure which engages, potting resin to insert into hook part of this hook structure, to be included, at same time, because contact area of heat release sheet and the potting resin (mold resin) becomes large, with low thermoresistivity, at same time, exfoliation and crack which occur in boundary of heat release sheet and the potting resin can be decreased.

Exfoliation and crack which occur in joint interface between different material of namely, thermal expansion coefficient, modulus can be decreased.

[0021]

In addition, potting resin to insert into this penetrating hole, by providing the penetrating hole of inverted cone or inverted pyramid condition in heat release sheet, to be included, at same time, because contact area of heat release sheet and potting resin becomes large, with low thermoresistivity, at same time, exfoliation and crack which occur in boundary of heat release sheet and potting resin can be decreased.

[0022]

In addition, potting resin of package to insert into this hole, by providing hole of inverted cone or inverted pyramid condition in inside surface part of the heat release sheet, to be included, at same time, because contact area of the heat release sheet and potting resin becomes large, with low thermoresistivity, at same time, exfoliation and crack which occur in boundary of heat release sheet and potting resin can be decreased.

[0023]

In addition, because contact area of heat release sheet and potting resin becomes large by providing unevenness in inside surface part of heat release sheet, heat emission efficiency it can improve.

[0024]

In addition, furthermore, heat emission efficiency it can improve by providing the heat radiating fin in top of the aforementioned heat spreader.

[0025]

Below, concerning this invention, referring to drawing, with embodiment you explain in detail.

[0026]

Furthermore, those which possess same function in all figure in order to explain embodiment, attach same code, abbreviate repeated explanation.

[0027]

[Embodiment of the Invention]

(embodiment 1) As for Figure 1 with top view and sectional view which show conceptual configuration of semiconductor integrated

circuit device of package of HBGA type of embodiment 1 of this invention, as for (a) as for top view, (b) it is a sectional view which is cut with the A-A' line of (a).

In Figure 1, as for 1 heat spreader (heat release sheet), as for 1 A as for hook structure, 2 the mold resin (potting resin), as for 3 as for LSI chip, 4 as for metallized substrate, 5 ball (outside electrode), as for 6 it is a metallized electrode (pad) which is provided on metallized substrate 4.

[0028]

As for semiconductor integrated circuit device of package of HBGA type of this embodiment 1, as shown in Figure 1, mold resin of main surface and opposing side where semiconductor element of the LSI chip 3 is formed (package) on surface of 2 heat spreader (heat release sheet) with semiconductor integrated circuit device where it can provide 1, description above heat spreader periphery edge of 1 part hooking the aforementioned mold resin 2 at least, it is something which becomes hook structure 1A which engages.

namely, ball (outside electrode) on metallized substrate 4 where 5 is provided, metallized electrode (pad) through 6, you install LSI chip 3, mold resin (potting resin) seal with 2, periphery edge part hooks the aforementioned mold resin 2 at least on that and it possesses hook structure 1A which engages heat spreader 1, inserts into mold resin 2 and has become configuration which is included.

angle q of hook of the aforementioned hook structure 1A is acute angle ( $q < 90^\circ$ )

[0029]

It possesses the aforementioned hook structure 1A, heat spreader means which inserts 1 into mold resin 2, when sealing with for example mold resin 2, beforehand has hook structure 1A, heat spreader it locks 1 inside die, it produces by integral molding doing.

[0030]

stress which occurs at time of this, by selecting heat spreader 1 of material (for example copper) which is close to thermal expansion coefficient of mold resin 2, due to thermal expansion coefficient difference can be decreased.

[0031]

this way mold resin 2 of package to insert into hook part of the aforementioned hook structure 1A, by configuration doing, to be included, at same time, because description above heat spreader contact area of mold resin 2 of 1 and the package becomes large, with low thermoresistivity, at same time, mold resin 2 heat spreader exfoliation and crack which occur in boundary of 1 can be decreased.

With namely, low thermoresistivity, at same time, exfoliation and crack which occur in joint interface between different material of thermal expansion coefficient, modulus can be decreased.

[0032]

(embodiment 2) As for Figure 2 with top view and sectional view which show conceptual configuration of semiconductor integrated circuit device of package of HBGA type of embodiment 2 of this invention, as for (a) as for top view, (b) it is a sectional view which is cut with the A-A' line of (a).

In Figure 2, as for 1 B heat spreader it is a penetrating hole of inverted cone or the inverted pyramid condition which are provided in 1.

[0033]

As for semiconductor integrated circuit device of package of HBGA type of this embodiment 2, as shown in Figure 2, on surface of mold resin 2 of main surface and opposing side where semiconductor element of LSI chip 3 is formed heat spreader with semiconductor integrated circuit device where it can provide 1, description above heat spreader it is something which penetrating hole 1B of the inverted cone or inverted pyramid condition at least one is provided at least in portion inside plane of 1.

[0034]

In namely, the aforementioned embodiment 1, heat spreader in place of hook structure 1A of 1, it is something which provides penetrating hole 1B of inverted cone or inverted pyramid condition.

[0035]

Description above heat spreader penetrating hole 1B which is provided in 1 was buried with mold resin 2 and means which is inserted, when sealing with the for example mold resin 2,

beforehand provided penetrating hole 1B, heat spreader it locks 1 inside die, it produces by integral molding doing.

[0036]

this way mold resin 2 of package to insert into the aforementioned penetrating hole 1B, by configuration doing, to be included, at same time, because description above heat spreader contact area of mold resin 2 of 1 and package becomes large, with low thermoresistivity, at same time, mold resin 2 heat spreader, exfoliation and crack which occur in boundary of 1 can be decreased.

[0037]

(embodiment 3) As for Figure 3 with top view and sectional view which show conceptual configuration of semiconductor integrated circuit device of package of HBGA type of embodiment 3 of this invention, as for (a) as for top view, (b) it is a sectional view which is cut with the A-A' line of (a).

[0038]

As for semiconductor integrated circuit device of package of HBGA type of this embodiment 2, as shown in Figure 3, on surface of mold resin 2 of main surface and opposing side where semiconductor element of LSI chip 3 is formed heat spreader with semiconductor integrated circuit device where it can provide 1, description above heat spreader periphery edge of 1 part hooking the aforementioned mold resin 2 at least, we have become hook structure 1A which engages, Description above heat spreader it is something which penetrating hole 1B of inverted cone or inverted pyramid condition at least one is provided at least in portion inside the plane of 1.

[0039]

this way mold resin 2 of package to insert into hook part of the aforementioned hook structure 1A, by configuration doing, to be included, at same time, mold resin 2 of package to insert into the aforementioned penetrating hole 1B, to be included, because furthermore, description above heat spreader contact area of mold resin 2 of 1 and package becomes large, with low thermoresistivity, at the same time, mold resin 2 in heat spreader exfoliation and occurrence of crack furthermore can be decreased boundary of 1.

[0040]

(embodiment 4) As for Figure 4 with top view and sectional view which show conceptual configuration of semiconductor integrated circuit device of package of HBGA type of embodiment 4 of this invention, as for (a) as for top view, (b) it is a sectional view which is cut with the A-A' line of (a).

In Figure 4, as for 1 C heat spreader it is a unevenness which is provided in the interior plane of 1.

[0041]

As for semiconductor integrated circuit device of package of HBGA type of this embodiment 4, as shown in Figure 4, on surface of mold resin 2 of main surface and opposing side where semiconductor element of LSI chip 3 is formed heat spreader with semiconductor integrated circuit device where it can provide 1, description above heat spreader periphery edge of 1 part hooking potting resin of the aforementioned package at least, hook structure 1A which engages possessing, Description above heat spreader it is something which unevenness 1C at least one is provided in interior plane of 1.

The aforementioned unevenness 1C it is possible heat spreader with as structure which penetrates 1.

[0042]

this way mold resin 2 of package to insert into hook part of the aforementioned hook structure 1A, by configuration doing, to be included, at same time, because description above heat spreader contact area of mold resin 2 of 1 and the package becomes large, with low thermoresistivity, at same time, mold resin 2 in heat spreader exfoliation and occurrence of crack furthermore can be decreased boundary of 1.

[0043]

(embodiment 5) As for Figure 5 with top view and sectional view which show conceptual configuration of semiconductor integrated circuit device of package of HBGA type of embodiment 5 of this invention, as for (a) as for top view, (b) it is a sectional view which is cut with the A-A' line of (a).

In Figure 4, as for 1 D heat spreader it is a hole of inverted cone or inverted pyramid condition which are provided in interior plane of 1.

[0044]

As for semiconductor integrated circuit device of package of HBGA type of this embodiment 5, as shown in Figure 5, on surface of mold resin 2 (package) of main surface and opposing side where semiconductor element of LSI chip 3 is formed heat spreader with semiconductor integrated circuit device where it can provide 1, description above heat spreader it is something which hole 1 D of inverted cone or inverted pyramid condition at least one is provided at least in portion inside interior plane of 1.

[0045]

In namely, the aforementioned embodiment 1, heat spreader in place of hook structure 1A of 1, description above heat spreader it is something which provides hole 1 D of inverted cone or inverted pyramid condition inside interior plane of 1.

[0046]

Description above heat spreader means which imbeds hole 1 D of the inverted cone or inverted pyramid condition at least to portion inside interior plane of 1 with mold resin 2, when sealing with for example mold resin 2, beforehand provided the hole 1 D of inverted cone or inverted pyramid condition, heat spreader 1 is locked in the die, technique which is produced by integral molding doing is used.

[0047]

this way potting resin of package to insert into hole 1 D of the aforementioned inverted cone or inverted pyramid condition, by configuration doing, to be included, at same time, because description above heat spreader contact area of potting resin of 1 and package becomes large, with low thermoresistivity, at same time, mold resin 2 in heat spreader furthermore it can decrease boundary of 1 exfoliation and occurrence of crack in comparison with the aforementioned embodiment 1.

[0048]

(embodiment 6) As for Figure 6 with top view and sectional view which show conceptual configuration of semiconductor integrated circuit device of package of HBGA type of embodiment 6 of this invention, as for (a) as for top view, (b) it is a sectional view which is cut with the A-A' line of (a).

In Figure 6, as for 7 heat spreader it is a heat radiating fin

which is provided in top of 1.

[0049]

heat radiating fin is provided in heat spreader top of 1 of semiconductor integrated circuit device of package of HBGA type of the aforementioned embodiment 6, heat emission efficiency it is something which improves.

[0050]

Above, invention which it is possible with this inventor is not something which is limited in the aforementioned embodiment, fact that various it can modify is of course gist in range which does not deviate.

[0051]

#### [Effects of the Invention]

If effect which is acquired with inside representative ones of the invention which is disclosed in this application is explained simply, as follows is.

[0052]

(1) Portion of heat release sheet hooking potting resin of package, potting resin to insert into hook part of the aforementioned hook structure, by with becoming hook structure which engages, to be included, at same time, because the aforementioned heat release sheet and contact area of potting resin become large, with the low thermoresistivity, at same time, exfoliation and occurrence of the crack which occur in heat release sheet and potting resin boundary can be decreased.

Exfoliation and crack which occur in joint interface between different material of namely, thermal expansion coefficient, modulus can be decreased.

[0053]

(2) potting resin to insert into this penetrating hole, by providing penetrating hole of the inverted cone or inverted pyramid condition in heat release sheet, to be included, at same time, because the aforementioned heat release sheet and contact area of potting resin become large, with low thermoresistivity, at same time, exfoliation and crack which group raw are done can be

decreased in boundary of the potting resin and heat release sheet.

[0054]

(3) Because contact area of heat release sheet and potting resin becomes large by providing unevenness in inside surface part of heat release sheet, heat emission efficiency it can improve.

[0055]

(4) sealing resin to insert into this hole, by providing hole of the inverted cone or inverted pyramid condition in inside surface part of heat release sheet, to be included, at same time, because the aforementioned heat release sheet and contact area of potting resin become large, with low thermoresistivity, at same time, exfoliation and crack which occur in potting resin boundary can be decreased.

[Brief Explanation of the Drawing(s)]

[Figure 1]

It is a top view and a sectional view which show conceptual configuration of semiconductor integrated circuit device of the package of HBGA type of embodiment 1 of this invention.

[Figure 2]

It is a top view and a sectional view which show conceptual configuration of semiconductor integrated circuit device of the package of HBGA type of embodiment 2 of this invention.

[Figure 3]

It is a top view and a sectional view which show conceptual configuration of semiconductor integrated circuit device of the package of HBGA type of embodiment 3 of this invention.

[Figure 4]

It is a top view and a sectional view which show conceptual configuration of semiconductor integrated circuit device of the package of HBGA type of embodiment 4 of this invention.

[Figure 5]

It is a top view and a sectional view which show conceptual

configuration of semiconductor integrated circuit device of the package of HBGA type of embodiment 5 of this invention.

[Figure 6]

It is a top view and a sectional view which show conceptual configuration of semiconductor integrated circuit device of the package of HBGA type of embodiment 6 of this invention.

[Explanation of Symbols in Drawings]

1

heat spreader (heat release sheet)

1A

hook structure

1B

penetrating hole of inverted cone or inverted pyramid condition

1C

unevenness

1D

Hole of inverted cone or inverted pyramid condition

2

mold resin (potting resin)

3

LSI chip

4

metallized substrate

5

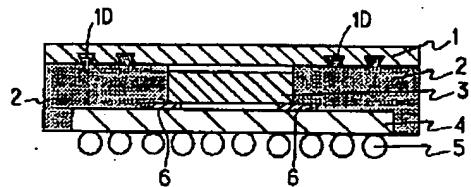
ball (outside electrode)

metallized electrode (pad)

heat radiating fin

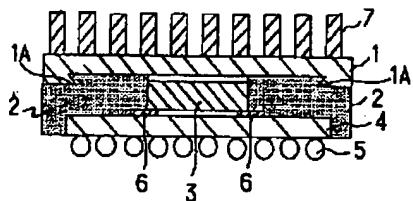
[Figure 5]

図 5



[Figure 6]

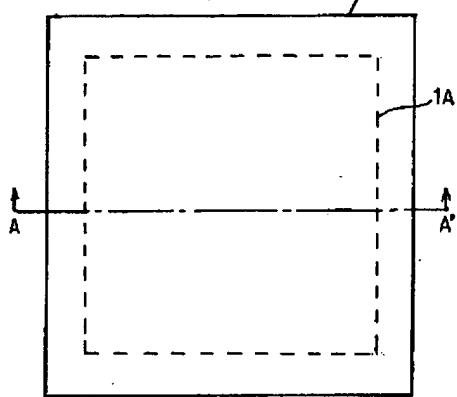
図 6



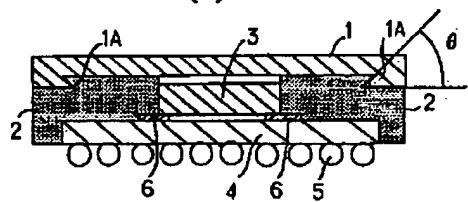
[Figure 1]

図 1

(a)



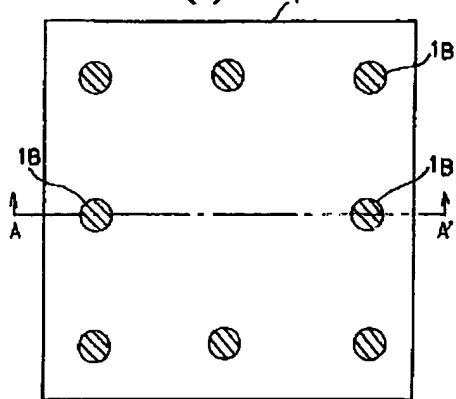
(b)



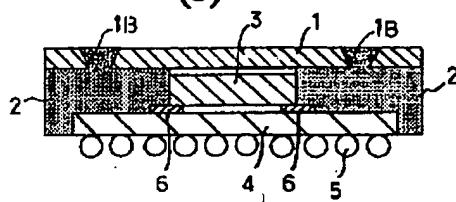
[Figure 2]

図 2

(a)



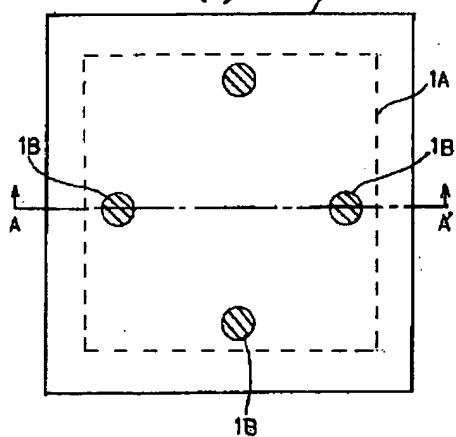
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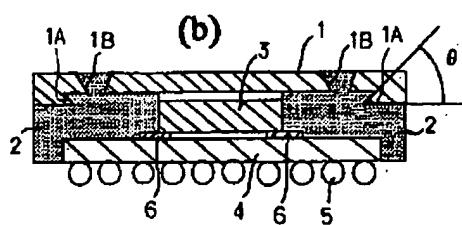
[Figure 3]

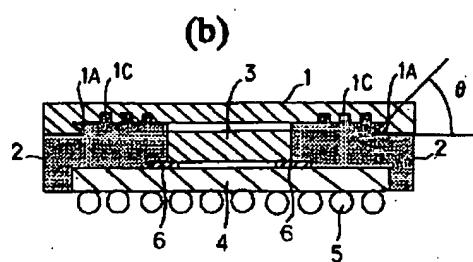
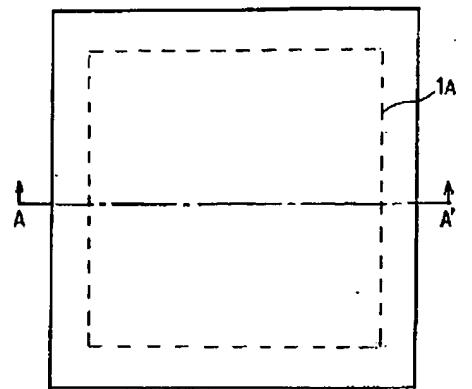
図 3

(a)



(b)





[Figure 4]